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CITY ENGINEER W. W. Brigden, of Erie, Pa., writes us that that city has just finished several squares of stone pavement, Medina center and cobble sides. For several years past Erie has had about $15,000 per year of paving done, and expects next year to lay $35,000 worth, of which $20,000 is to be asphalt. A two-foot brick sewer has just been completed, and two pipe sewers are under way. Public work has increased rapidly in amount in the past five years, and the indications are that, with continued good times, as at present, property owners will petition for much more new work.

THE PROSECUTION OF IMPORTANT UNDERTAKINGS depends often on easy money markets, cheap material and a healthy commercial activity. The present industrial situation affords abundant encouragement for the extraordinary investments in progress. The two most marked features of the iron market just now are the advancing tendency of merchant and construction iron, and the weakening tendency in railway material. Merchant iron has advanced in Eastern markets from $2\frac{3}{10}$@ $2\frac{4}{10}$@3c., where it now stands, under a very active demand, with production lagging behind still. The vigorous efforts being made to increase the output will very soon be felt. At present orders cannot be placed easily, and most of the business accepted within two weeks has been at prices to be named afterwards. The opinion has been gaining strength that prices of bars and some other kinds of iron will advance during January, and late advices from abroad have strengthened the belief. These apparently conclusive evidences should be taken cautiously, in view of the uncertainty surrounding the foreign markets and the steady expansion of domestic capacity. The condition of the iron trade west of the mountains is quite vigorous. The trade has not yet been compensated for the scarcity of iron occasioned by the long, hot summer and the idleness in the Cincinnati mills caused by a strike. The spread of population West, the increasing acreage, the expansion of boat and barge building for the Western lakes and rivers, with other causes, have combined to create an extraordinary demand for iron and its products in the West, which has enhanced values to the present unusual limits. Furnaces and mills are sold ahead. Fuel is relatively scarce, and consumptive wants are being anticipated as far as can be done without stimulating prices. The present tendency of prices is therefore to a higher level, and manufacturers have recently been insisting on outside quotations in view of the advance. Foreign iron shows no more probability of coming in than two weeks ago. Domestic productive capacity is barely equal to requirements, although it is being increased, and while these causes continue to act, very firm prices may be expected.

The situation is different with railway material. The demand has not abated in the least; manufacturers of steel and iron rails are receiving inquiries constantly for future deliveries, and numerous orders are being placed. Foreign mills are pretty well filled up. Quotations abroad have been advanced within a few days, ocean freights are scarce, and uncertain. In the United States the expansion of capacity has at last begun to affect quotations for distant deliveries, and within a few days prices on large contracts closed have declined sharply. One new rail mill is projected; improvements are in progress in others. The extension of railway facilities to new mines promises to effect a much-needed reduction in raw material. Bessemer pig is advancing because of extraordinary demand; but causes are at work even in that branch of production which will reduce cost. Old rails also have at last begun to weaken, and iron rail mills will be provided with blooms and old rails in a few weeks, at prices which will enable them to utilize their capacity to maintain the supply of rails at maximum limits.

METRICAL MEASUREMENTS.

At a late meeting of the International Institute for the Preservation and Perfecting of Weights and measures, held at Cleveland, Ohio, Nov. 26, addresses were made by the president and others, and letters read from individuals in sympathy with the object of the Institute.

In a report of the Secretary we find the following:

"Already it is conceded by members of the British Parliament that the effective dissemination by this institute of instructive information regarding the evils of the French metric system, through the public press, auxiliary societies, lectures, pamphlets, etc., has created a strong determination for the extinction of even its permissive use throughout Great Britain, and quite recently an act of Parliament has been passed to that effect. It being expedient that more aggressive steps be now taken for the extinguishment of this evil in the United States, another memorial is now being circulated for signatures, praying Congress that hereafter no weights or measures, other than the Anglo-Saxon—as modified and defended by the United Stated statutes—shall be used in any branch of the public service whatever, until otherwise ordered by act of that body.

"Over 1,000 signatures to it have been obtained in the city of Cleveland within a short time. These memorials have been sent by thousands all over the United States, to those representing the different classes of men, with the request that when the signatures were obtained, they would promptly forward the same to their respective members of Congress, for action."

We hope the Secretary, in sending his circulars, included as little as may be of the proceedings of this convention, if we may judge of its character from the four columns of solid matter in the Cleveland *Leader* of the 25th and 26th.

We extract from a letter from Mr. Muir, of Melrose, Scotland, as follows:

"All that about the British Inch in the Great Pyramid is pure moonshine. It cannot be. It is contrary to the fundamental nature of the case. There is no measure in the Great Pyramid which is not a kosmic commensuration. The British Inch is out of truth (as the British people themselves are) with the Kosmos. Else would there be no need that Elias come to restore all things. * * * This is of immense moment, because it was the first step that led to the discovery in the Great Pyramid of the expression of the annual amount of the sun's shift in space, viz.: something more than 170,000,000 miles; I have not the figures before me."

This allusion to the British Nation, as also to Elias' second coming, is very happy, and as an argument decidedly convincing. The determination by this means of the sun's proper motion in space is important if true, which, unfortunately, we are lacking in means to verify. Another strong argument is offered by a member as follows:

"As to the objects in view by the society, I would say that my whole heart is still in sympathy with them, and, I doubt not, ever will be. As each year passes by it adds to the already strong chain of evidences going to show that the Anglo-Saxon race is unlike all other races—it is an overshadowing race, and apparently destined to spread over all the earth, and that this people are the inheritors of the original God-given system of weights and measures, as treasured in that grandest of ancient monuments, the Great Pyramid of Egypt. The links of this chain of evidence reach back far, far into the deep past age, beyond the flood, and it seems to carry us back almost to the very gates of Eden, if not into the garden itself."

But leaving the pleasant walks of Eden with some reluctance, we are repaid by some glimpses of common sense in a letter from an American engineer in Mexico as follows:

"EXTRACT OF A LETTER FROM MR. A. M. WELLINGTON SUPERINTENDENT OF CONSTRUCTION OF MEXICAN NATIONAL RAILWAY.

"Tell Mr. Latimer that I am not yet more in love with the metric system than in Cleveland. The simple truth is, that for railroad surveys, at least, the 100 foot chain, 10 foot poles and contours, and one foot lines on profile paper, are noticeably more convenient than the metric equivalents. Our surveys were begun in the first system, but the government required a change, which—largely by inexcusable shiftlessness in headquarters—has introduced the d——l's own confusion in the system of keeping maps, notes and surveys. We have twenty meter stations, 25 meter and 100 meter; two different horizontal scales for profiles, and three different vertical 2 meter and 3 meter space for contour lines, and the d——l knows what all, so that a profile or map means hardly anything; but much of this is not to be chargeable to the system."

We have had knowledge of the labors of this anti-metric society for some time, but was not aware until lately that such stuff as was gravely read at this meeting had the countenance of the officers of the association, and would recommend that this twaddle about the pyramids of Egypt, or the measures which the Almighty by revelation had intended man to use, be omitted from the printed proceedings of the association, as calculated to weaken their claims to consideration.

We do not notice the labors of this convention with a view to provoke discussion as to the merits or demerits of the metric system—on the contrary, we would deplore any such result, there having been enough already written on the subject—but there is one point upon which we think there is a misapprehension, and that is, that the meter, the unit of the French system, possesses some advantages as a universal standard not offered by any other conceivable measure of length, and that if all the meter measures in the world were destroyed, it could be restored by recourse to the same process by which it was originally determined, and this with more certainty, accuracy and ease than any other standard in existence. If this be not so, it is a very unscientific proceeding for us to change our standard of measure for one which possess none of the claims to universality in its restoration urged by its advocates. When the meter was adopted in France, it claimed to be the *one ten-millionth part of the quadrant of the meridian of the earth's surface.* This was ascertained by measuring ten degrees of a meridian passing through Paris, and from this deducing the remainder. The true figure of the equatorial circumference of the earth not being fully understood then, the inference was allowed to obtain that the same result will follow the measurement of a quadrant of any other meridian. But it is now known that, owing to irregularities in the figure of the earth, not only do such meridians differ in length among themselves, but that the measure of the French meridian was, to a certain extent, at fault, and therefore, the meter to that extent not what it purported to be; and in the enactment establishing the meter as the standard in France, its reproduction, in the event of its loss, is made to depend, not upon any measure of a meridian, but upon reference to the length of a pendulum beating seconds at Paris. Now if Paris was the center of the earth this might be regarded as sufficiently universal in its application to the purpose, did we possess nothing better—but we do.

If a dozen meridians were measured, differing among themselves, yet the polar axis of the earth,

a simpler element of the earth's figure, would be measurably constant, and a unit of measure referred to that line less objectionable on the score of non-universality. Such a unit is the English inch, as now in use, which differs less from the 500,500,000th of the polar axis than does the meter from the $\frac{1}{10000000}$ th of the earth's quadrant.

If the English inch were increased in length by $\frac{1}{1000}$th, a quantity not appreciable to the senses, it would be *exactly* $\frac{1}{500500000}$ of the earth's polar axis.

This subject, showing the effect of taking the English yard of thirty-six inches and the foot of twelve inches, in lieu of the meter, is treated by Sir John Herschel in his usually masterly manner, and we commend the reading of it to such as are disposed to go the Pyramids for the establishment of the English inch as a universal unit of measurement, while its value to the English-speaking nations of the world rests upon characteristics of far greater value than the bare *presumption* of Divine revelation.

VENTILATION.

With respect to ventilation, it is the thing that the natural man abhors. In reference to it, I feel inclined to paraphrase that which has been said about charity, namely, that it is an emotion of the mind in which A never sees B in want, without desiring to relieve him, not with the goods of A, but with the goods of C. Similarly, it may be said that when A feels the atmosphere of a room stuffy, he desires it to be changed, not at the risk of himself, A, catching cold, but at the risk of B, or any person other than A. If a proof of this were wanted, let me refer you to any assembly where there is some big man whose orders are taken—a judge on the bench, or a chairman of a meeting. What is the direction to the attendant when the judge or chairman feels there is a need of ventilation? "I feel the air of this court or room very close; open two of those windows down there;" not "open two of the windows near me." The big man with the natural fear of ventilation, lets somebody else bear the burden, while he himself gets the benefit. It is very rarely indeed that the man "down there" has either the readiness or the courage to protest. The only instance that occurs to me of the kind is that of Sydney Smith, when, as a curate, sitting at a dinner largely attended by the higher orders of the clergy, he said to the waiter, who was about to open a window close by, "Don't give me my death of cold; open one behind a bishop."—*Sir F. J. Bramwell to the Society of Arts.*

We think it was Dr. Franklin who said that "Public health is public wealth," or if he did not, he might well have said so, and nothing is more important toward this end than the knowledge of how the first requisite toward the attainment of the conditions of public health can best be obtained. The first necessity of life is air, and that the poisons constantly being disseminated from the surroundings attendant upon civilized life (if they cannot be dissipated entirely), shall be diluted to the extent of harmlessness: proper ventilation becomes a necessity.

So much has been written on ventilation, and so much has been done avowedly with that intent, but so obviously failing of the result promised, that the subject has come to be regarded as one of which no one has yet grasped the principles, but in its leading features ventilation presents no complexity as applied to single apartments, though a deficiency of knowledge in those who conduct or manage it often renders the most simple and reliable plans of little or no use.

We have read with much interest a book published by Van Nostrand, entitled "New System of Ventilation; a Book for the Household, by Henry A. Gouge," and having ourselves witnessed the successful working of the system proposed, which is neither intricate nor expensive, we can commend the work as worthy of attention, the system being based upon sound principles. Whether the book of some 175 pages is for sale, or is for gratuitous circulation, we are not informed, but recommend it as interesting reading, even to such as do not feel the need of special appliances for securing fresh air.

PERSONAL.

Mr. Silas Seymour, New York State Engineer and Surveyor elect, took the oath of office before the Secretary of State, at Albany, on the 19th.

Dan. T. Casement, of the well-known contracting firm of Casement Bros., died in this city on the 14th inst, aged forty-six.

Assistant Engineer George S. Willets has been ordered to take charge of the department of steam engineering and ship building in the Franklin Institute of the State of Pennsylvania.

Russell Hardin, for a long time agent of the International Improvement Company at San Antonio, has been appointed superintendent of construction on the Texas-Sabine Railway, with headquarters at Trinity.

Mr. G. W. Waite, late Chief Engineer of the Chicago, Texas & Mexican Central, has gone with a corps of engineers to Rosenburg Junction to accept a position on Count Telfener's Texas & Mexican road as locating engineer.

Mr. W. J. Sherman has been appointed Engineer in Charge of Roadway, Bridges and Buildings of the Louisville, New Albany & St. Louis Railway Co., with office at Evansville, Ind. He will have full charge of maintenance of way, bridges and buildings.

J. T. Jones, Civil Engineer, who has had charge of the opening operations of Palestine (Texas) Water-works, assumes charge for the same company of the water-works at Vincennes, Ind. On the 12th he was tendered a complimentary supper by the city officers and merchants of Palestine.

Colonel Newman was at Palestine, Tex., on the 15th, on his way to the City of Mexico, where he goes, taking with him an engineer corps to commence locating from that city to meet the International locating party already on the way down the Rio Grande valley toward the capital of Mexico.

Mr. Graham Smith, C. E., Past President of the Liverpool Engineering Society, and with whom as a writer and correspondent for engineering journals our readers are quite well acquainted, has been appointed Engineer in Chief to the port of Rangoon, India, at a salary of $6,000 per annum. Mr. Smith left England for his new post on the 7th inst.

D. W. Washburn, Chief Engineer of the Gould construction companies, will establish his office at Laredo. A branch office will be built at Fort Worth, from which the building of the Fort Worth & Denver Railway and Missouri Pacific Railway will be directed. From Laredo the extension of the International & Great Northern south to the City of Mexico will be managed.

Wm. P. Shinn & Co. is the name of a firm recently formed for the purpose of transacting a financial agency business at No. 16 Cortlandt street, New York, selling and placing bonds and stocks, negotiating and procuring capital for the building of railways, development of mining and manufacturing properties, and generally promoting transportation and industrial enterprises. Mr. W. C. Andrews is President of the New York Steam Co., and has since 1856 been identified with the railroad, coal and iron interests of the Mahoning Valley, O., as a member of the firms of Andrews, Hitchcock & Co., of Cleveland, O., miners and shippers of coal; Andrews Bros. & Co., of Youngstown, O., manufacturers of pig iron and shippers of coal, and as a projector and builder of railways in that valley. Mr. Andrews was also one of the projectors of and is largely interested in the Imperial Coal Co. and Montour Railroad Co., near Pittsburgh, Penna. Mr. Wm. P. Shinn is President of the New York Manganese Co., and has since 1850 been engaged in the location, construction and operating management of the Pittsburgh, Fort Wayne & Chicago Railway, Ashtabula & Pittsburgh Railway, and the Alleghany Valley Railroad, having been Vice-President of the A. V. R. R. Co., President of A. & P. R'y Co., and having filled several responsible offices in the P., F. W. & C. R'y Co.; he was for five years the engineering expert of the Pennsylvania Railroad Co., charged with examining and reporting upon railroads, with a view to their purchase, lease or control by the P. R. Co. Mr. Shinn was interested in the Edgar Thomson Steel Co. (Limited), and as General Manager had the general supervision of the building of its extensive works near Pittsburgh, and had the business management of the company's affairs during the first four years of its manufacturing operations. He was during 1880 President of the American Institute of Mining Engineers, and is a member of the American Society of Civil Engineers.

VAL DE TRAVERS ASPHALTE.

Asphalte appears to have been used from the earliest period of the history of constructive works, its peculiar adaptability and the comparative ease with which it could be obtained combining to render its use general. It is claimed that the antiquarian researches of savants have shown that it was used as a binding material in the buildings of Babylon, and as corroborative evidence we are pointed to various localities from whence it could have been obtained. In 1721 a work was published by Dr. d'Eyrinis, in which he strongly advocated its use for all purposes for which cement and mortar were applicable.

It was used as a street pavement in Paris in 1838, but soon after, as it came under the control of machinators—in this case financiers—who claimed for it properties making it suitable for every conceivable form of work, in fact a sort of constructive specific, it was held in disrepute. It was not until 1854 that the Rue Bergière was paved with compressed rock of the Val de Travers, and after a continued use of fifteen years portions of this road were removed, when it was found that the asphalte had lost but five per cent. in weight and had been reduced in thickness from two inches to one and three-quarter inches. From this as a beginning the use of asphalte has grown to its present proportions. In Austria there are 65,492 square meters of carriage roads, sidewalks, etc.; in Hungary, 163,235 square meters; in Paris a very large area; in Berlin 112,000 square meters of carriage road; in London 482,000 square yards of Val de Travers, or, as it is better known in this country, Neuchatel asphalte.

Val de Travers asphalte is a carbonate of lime naturally impregnated with from nine to thirteen per cent. of bitumen, and is obtained from the company's mines of the same name in the Canton of Neuchatel, Switzerland. From a paper by E. P. North, C. E., before the American Society of Civil Engineers, on the Construction and Maintenance of Roads, and for which the Norman medal was awarded, we take the following analysis of this asphalte:

September, 1876; 5 *samples*:					
Bitumen	9.46	9.48	11.98	11.96	10.06
Carbonate of lime	90.54	90.52	88.02	88.04	89.94
	100.00	100.00	100.00	100.00	100.00
Loss at 212°	1.46	1.42	3.04	3.22	1.92

"The loss was moisture and light oils. A small amount of silica was estimated with the lime."

In a series of analyses by M. Durand-Claye, Engineer-in-Chief, Director of the Laboratory *Ponts et*

Chaussées, of various asphaltes, we find the following of Val de Travers:

Water and volatile matters at 100° Centigrade	0.35
Matters soluble in sulphuret of carbon (bitumen)	8.70
Sand	0.60
Sulphur	0.08
Iron combined with sulphur	0.21
Alumina and peroxide of iron	0.30
Lime	49.50
Magnesia	0.10
Carbonic acid and waste	40.16
	100.00

"Sample No. 1 (the above) is an almost pure limestone impregnated with bitumen. It is asphalte in the proper sense of the word."

The asphalte is laid in two forms—compressed powder and mastic. The pure rock as it comes from the mines is crushed in a Blake crusher, and then ground fine by a Carr disintegrator. The foundation upon which the powder is laid consists of one part of best English Portland cement to eight parts of broken stone and sand, laid from five to eight inches thick, according to the locality and the consequent amount of traffic. After the foundation has thoroughly set, the powder, having been heated in revolving cylinders to between 260° and 280° F., is spread by means of rakes to such thickness that when compressed it will be from one and one-half to two and one-half inches thick—depending also on the amount of traffic. The compression is effected by iron rammers, or *pilons*, which are rods of iron having an iron disk covering the lower end, the tool weighing about twenty-two pounds. The work begins with light blows, and ends with vigorous ones, it being finished when the blow produces a resonant sound. After the surface has been thoroughly compacted it is tested with a straight-edge and rubbed with smoothing irons or *lissoirs*, which consist of a curved iron, weighing about thirty-eight pounds, attached to a handle. These tools are heated, as the powder would stick to them if cold. After having been dusted with cement and allowed to cool the traffic is turned on.

The mastic is the pure powder to which has been added a certain percentage of refined bitumen. The bitumen is melted in an iron boiler, and the powder is added and stirred until the two are thoroughly incorporated, when the resulting mixture is run into hexagonal molds, bearing the trade-mark of the company. When required for use the cakes are broken into pieces, weighing about five pounds, and remelted in caldrons with a small quantity of refined bitumen. When melted, dry silicious gravel is added, in proportions varying from thirty to sixty per cent., and the whole is well stirred until the grit is thoroughly incorporated with the mastic. This is now carried to the work in pails and spread with wooden floats and rubbed until the surface is perfectly smooth. This mastic is particularly applicable for sidewalks, light carriage ways and floors of warehouses, etc.

In the remainder of this article we shall consider the questions of durability, original cost and maintenance, sanitary advantages and such other features as may be both interesting and instructive. From a paper by E. B. Ellice-Clark, C. E., associate member Institution Civil Engineers, we find that M. Chabrier made the statement that the effect of wear and tear on asphalte is so trivial that it may almost be said to be imperishable so long as no other cause than friction of wheels occurs to alter its working conditions. Mr. Clark does not accept this statement without challenge, but says that "the wear is unquestionably so light that exaggeration is not necessary, even by partisans." Some of the heaviest traffic streets of London, Eng., have been laid with asphalte, and in a letter from Col. William Haywood, City Engineer, dated September, 1876, we find the following sentence:

"The first specimen of Val de Travers' Compressed Asphalte was laid in the carriageway of Threadneedle street, in May, 1839; it is in good condition now. Towards the end of 1870, Cheapside and the Poultry were laid with the same material; these thoroughfares are subject to an enormous traffic; the pavements are still in good condition."

In Threadneedle street there were laid 485 yards, and in Poultry and Cheapside 7,854 yards. Mr. Clark states that he examined the first mentioned street a few weeks prior to the date of his paper (August, 1879), and found it in good condition, except where places had been cut out for experiments or repairs. He estimated that it had been subjected to a traffic of 200,000 tons* per annum per yard of width.

Further reports upon specimens taken from the streets of London prove that asphalte is compressed without appreciable wear under heavy traffic; a piece from Cheapside, which was first laid two and one-quarter inches thick, had been reduced in bulk five-eighteenths of an inch, and had lost two-sevenths in weight. In Grace Church street, when the annual traffic amounted to 603,000 tons per yard in width, the material had lost but an inconsiderable percentage in either bulk or weight. Results in the cities on the continent of Europe are substantially the same, and all tend to prove that when properly laid upon a durable and unyielding foundation asphalte takes high rank as a pavement in respect to durability.

Original cost and maintenance seem to be the main items considered by most city authorities, who completely ignore more important considerations. In Mr. Clark's paper we find the following table, in which the cost is reduced to 100,000 tons per annum per yard of width:

DESCRIPTION.	Original cost per square yard.	Interest on original cost	Sinking fund at 3 per cent. compound interest.	Maintenance per square yard.	Scavenging per square yard.	TOTAL.
	s. d.	d.	d.	s. d.	s. d.	s. d.
Wood (Liverpool)	15 1.5	7.5	10.1	0 1	5.0 gv'l	2 2.3
Val de Travers compressed asphalte	18 0	9.7	...	0 3.6	0.4	1 1.7
Granite	17 9	9.6	0.5	0 1.3	2.5	1 1.9
Macadam	4 9	2.1	....	3 6	12.0	4 8.1

No charge is made for the renewal of asphalte in the above table, as the annual sum for maintenance provides the asphalte in perpetuity. This sum for maintenance in London is an annual amount paid by the city to the company, and in consideration of which the company assumes all responsibility in regard to wear, and agrees to keep the roadway in perfect condition. We have no statistics from which we could tabulate the first cost in this country, but from the records we have of the durability of asphalte the cost of maintenance would be inconsiderable.

From a sanitary point of view the advantages to be derived from asphalte are apparent. Streets paved with a smooth, impervious surface, which offers no place for the lodgment of dirt, are of the utmost importance, because of increased cleanliness. The following table shows the result:

MATERIAL.	Superficial yds. for each load of mud.	Traffic in tons per annum per yard in width.
Macadam	344	25,000
Granite	500	50,000
Wood	1,000	25,000
Asphalte	4,000	500,000

General observations place the materials regarding absorption as 1, macadam; 2, wood; 3, granite and 4 asphalte.

Mr. Mauric Bixio, President of the Paris General Cab Company, has compiled the following table in regard to traction of the four-wheeled cab weighing 1,447 pounds, on various kinds of pavements:

Traction on rough pitching	36 lbs
" small sets	32.5 "
" macadam	30.8 to 45 "
Compressed asphalte (Val de Travers)	28 "

Much has been said concerning the slipperiness of asphalte, and without being given an adequate trial it has been severely criticised on this point. A horse will become accustomed to a certain kind of roadway, over which he constantly travels, but suddenly drive him upon a short stretch which is new to him and presents a different surface, upon which he must obtain a foothold, and he will fall more frequently than upon the old. Observations in London and Paris show that a horse will travel further without accident upon asphalte than he will upon granite. In those cities, as we have before shown, there is a sufficient length of asphalte to enable the horse to become accustomed to it and to travel accordingly. For these reasons, judgment should be carefully considered in regard to asphalte in this city, as it is only laid in comparatively small areas and as the difference between cobble-stone and asphalte is so great as to even take the horse by surprise when he suddenly goes from one to the other. Mr. Delano states that "Asphalte is not slippery *per se*, but it becomes so if a coating of greasy mud is allowed to remain upon it. Roadways of asphalte, from the same mines as used in London, are laid in Paris, and the complaint of slipperiness does not arise. This immunity is not the result of a drier atmosphere, as some have supposed, but simply that in the latter city the roadways are regularly swept and washed, whereas in London they are not."

The benefits which would be derived by the residents of private houses if streets were paved with a smooth, noiseless surface are too apparent to need discussion, and have been dwelt upon by the medical profession, who consider the noise produced by travel over rough streets as extremely detrimental to health.

European cities recognize the superiority of asphalte as a pavement, and are continually increasing the area; in the city of London alone, as we learn from a late copy of *The Mail*, the expense of paving last year was as follows: Granite, £10,853; wood, £7,632; and asphalte, £18,647. New York is slowly following these examples, and it is to be hoped that it will, in the near future, replace its stone pavement with one which would be sanctioned by sanitarians and doctors, and which would greatly lessen the work of the steeet cleaning department.

We recently examined the pavement in front of the Hotel Brunswick, which was laid by the Neuchatel Asphalte Company, Astor House, this city, and found it to be as perfect in appearance as when first laid in July, 1879. Although horses are continually standing along the curb in front of the hotel, the surface of the asphalte showed not the slightest sign of mark or wear, nor had the asphalte in this place ever been repaired. The area of this piece is about 1,000 square yards, and although subjected to a large traffic, it has required no repairs except some two or three yards, which became imperfect from the settling of adjacent flagging. Another piece has just been finished, between Eighth and Ninth streets and Clinton and Waverley places, on Fifth avenue, and although at the time of our visit this had been completed but a short time, no impression was made upon it by passing trucks heavily loaded.

* "These weights are approximate and probably considerably under the actual weights. Each vehicle is taken to weigh 1½ tons; probably 50 per cent. might be added to them; but, as there are no means of ascertaining the weights exactly, Colonel Haywood has never given weights in his reports, so that in comparing these figures with those given by other writers, the vehicles must be reduced to the standard of 1½ tons weight each, and the traffic is for twelve hours only each day."

The City of Newcastle, Pa., after a long struggle has at last got water-works in operation. They have been tested and accepted.

THE HUDSON RIVER TUNNEL.

Since our last notice of this undertaking all the various branches of the work have been pushed forward vigorously and successfully. The north heading is now completed about 680 feet from the eastern side of the old working shaft; the south tunnel is finished for a distance of about 525 feet. The average rate of progress for the past thirty days has been three feet every twenty-four hours. This means completed work and covers all the operations. This three feet required excavated material amounting to 40 cubic yards, about three-fourths of which was taken out of the tunnel and deposited some 1,000 feet west of the shaft, where it serves as an excellent filling for the low-lying lots. The remaining silt is thrown back into the finished tunnel, and on it is laid a platform and portable track.

One foot of tunnel requires 120 cubic feet of masonry, one-half of which is concrete and the other half brick; in other words, 1,200 bricks, two and one-half cubic yards of broken stone, six barrels of cement and 10 barrels of sand are used in each tunnel for every foot advanced. At present the silt at the heading is very firm, and could not be better calculated for rapid work by the Plenum process. It has been found, however, that the differences between the maximum and minimum pressures which are most advantageous, are small being only about two pounds per square inch. If the air pressure be increased one pound above what is called "standard," the material becomes too dry, and flakes off in pieces varying in size from the hand to a cement barrel. On the other hand if, from any cause, the pressure be reduced, even one pound below standard, the silt becomes moist and rapidly softens. This standard pressure approximates very closely a column of water of a height equal to the distance from the crown to the surface, but is determined chiefly from actual observation of the condition of material at the point of attack. The working pressure is now about twenty-two pounds per square inch above the atmosphere, at mean low water, and the work is being carried on at a depth of forty-two feet to the crown and sixty-four feet to the bottom of the invert.

Probably the fact that the heading could be or has been advanced at any time without "excavating," any material may be novel and suggest subterranean cavities offering facilities to progress, and though sufficiently novel, it is performed with the greatest difficulty, attended with danger to the men engaged upon it, with the liability of bringing the whole work to a halt. It is a necessary resort in some cases of tunneling very soft material containing sufficient moisture to permit it to flow as freely as quicksand. Suppose the condition of the heading to be as shown in Figure 1, in which *B* is finished brickwork, *D* iron plates, *S* a temporary bulkhead to prevent influx of material; it is desired to put in another ring of plates beginning at *A*. Preparatory work consists in bringing into the heading some quite dry silt that can be made into balls from five to eight inches in diameter. A hole large enough to admit the hand is cut through the bulkhead at *A* and a ball of silt worked into the opening as a kind of plug. A second is forced in which crowds the first backward and upward. A frequent repetition of this process soon forms a skin nearly impervious to air. This skin is worked back with the hand and as it is enlarged, more balls are supplied until the opening—as at *R*—becomes of the required dimensions to admit a plate, when part of this bulkhead is removed and a plate inserted. Of course considerable air escapes, making a very unpleasant noise, threatening a reduction in pressure and a consequent disturbance of the bulkhead, so that the operation requires men of skill, courage and coolness. From three to five hours hard work by ten men are necessary to successfully put in place an iron plate two feet six inches wide by four feet long without "excavating" any material.

It will be remembered that at a distance of between four and five hundred feet from the shaft a bulkhead had been built in each tunnel and two air-locks inserted—one being always open toward the heading. The method of building these bulkheads and the system of bracing are shown in Figures 2 and 3.

The work of connecting the "old working shaft" and "caisson," or, as it has been generally spoken of, as "cutting through the west side of the caisson," has been completed, and, while it presented none of the obstacles or terrors that had long been confidently anticipated, it was sufficiently troublesome to keep up a very lively interest in the minds of not only those engaged in this work, but also of all hands at work in the east heading of the north tunnel, seven hundred feet distant. Although none of the men actually refused to work, several took occasion to remain at home for needed rest, and two or three others, not liking to work at the heading, volunteered to assist in the "cutting through."

Our readers will recollect that at the time of the accident in 1880 the so-called temporary entrance to the tunnels was being finished and made per-

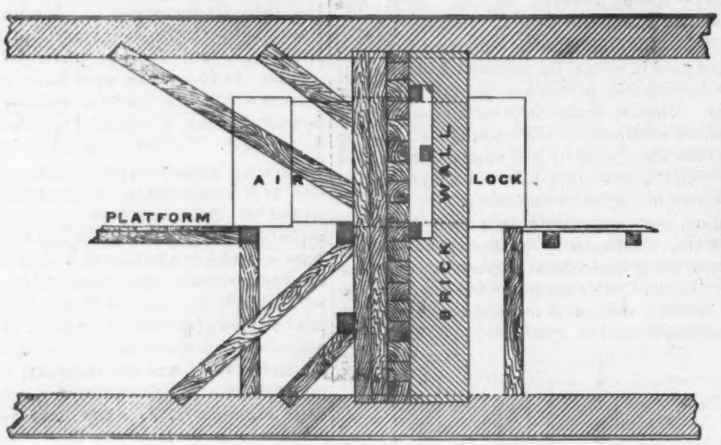

Fig. 2.

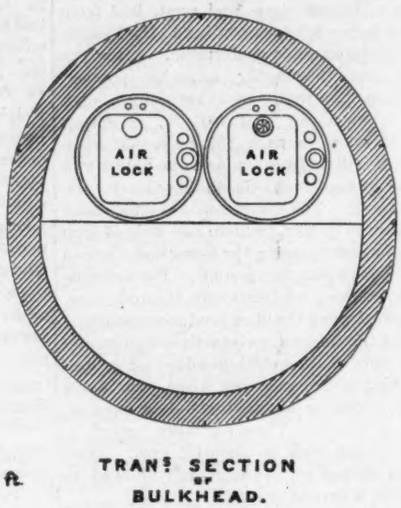

Fig. 3.

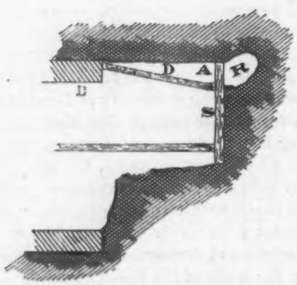

Fig. 1.

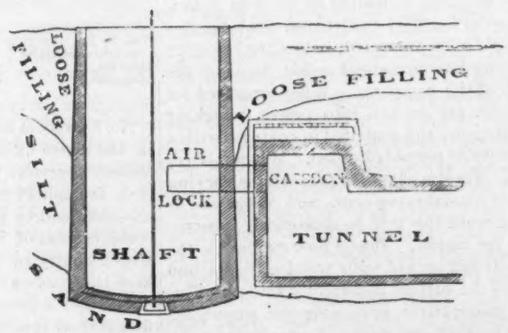

Fig. 4.—Longitudinal Section, New Jersey Side.

manent when it fell in; the caisson which was sunk at that time being about five feet less in width than the shortest distance between tunnel and shaft, and at the sides of the shaft about fifteen feet less, so that the connecting tunnels were wedge-shaped in plan, one side being curved to conform with the contour of the shaft.

After a protracted discussion of various plans for doing the work, one proposed by Mr. S. H. Finch, assistant engineer, was adopted, and its execution has been perfectly successful. This plan was simply to close the doors of the old air lock and shafts leading to the tunnels, admit the compressed air (from the shaft to the bulkheads the pressure had been taken off) and prosecute the work the same as at the heading. It being desirable to complete the connection as soon as possible for convenience in getting materials in to the men, preparations were made by sending down several days' supply of brick, sand, broken stone, etc., after which the old air-lock doors were closed and in three hours the pressure had increased to nine pounds per square inch. The "false" brick work which had been put in to inclose the caisson was taken out, as also the timber on that side of the work. The material was found to be quite dry and very compact, although about fifty per cent. of it was ashes and cinders mixed with silt. Figure 4 shows the different materials at the shaft. No trouble was experienced in placing the roof plates and the work proceeded rapidly, but with extreme caution. After the excavation had been made, the iron shell and a portion of the invert of the south connections put in, and when the silt had been removed in the north connection to within about three feet of the bottom, the water came in very quickly, rising some two and one-half feet in less than five minutes, and compelling a suspension of operations. A two inch blow-out being of no use, the pump in the shaft was connected to the standpipe and a full head of steam turned on, while the air pressure was increased to eleven pounds per square inch, when the water suddenly disappeared and the remaining silt was removed. But before the plates could be connected at the bottom, the water came in again with a rush, but receded with the tide, leaving the bottom dry, when the masonry was laid on the invert without further trouble. The following day the pressure was reduced to eight pounds. Afterward the sides of the shaft were taken out, thus completing the work.

The anticipated difficulty resulted from a knowl-

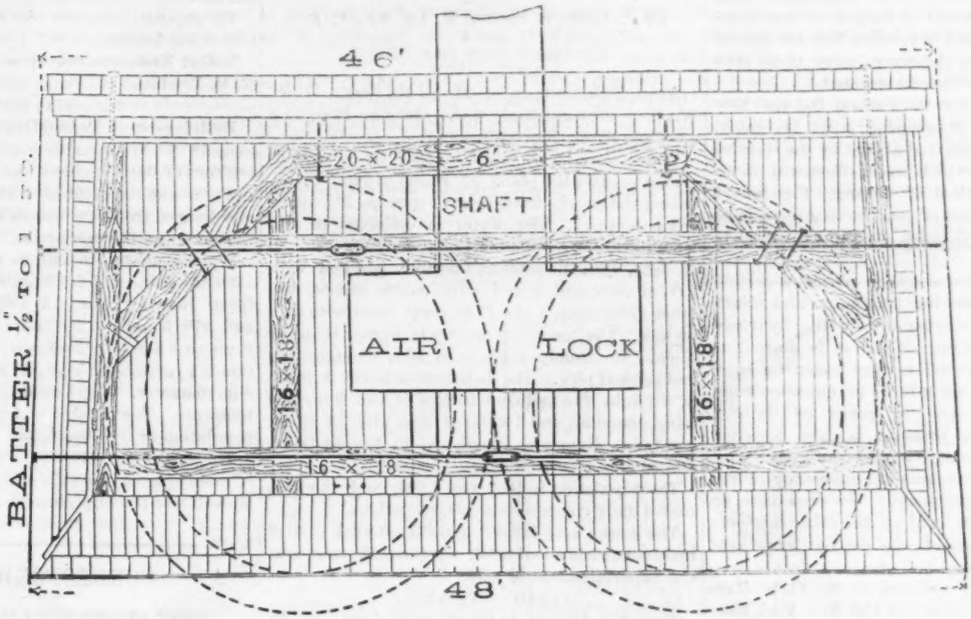

FIG. 5.—LONGITUDINAL SECTION, NEW YORK CAISSON.

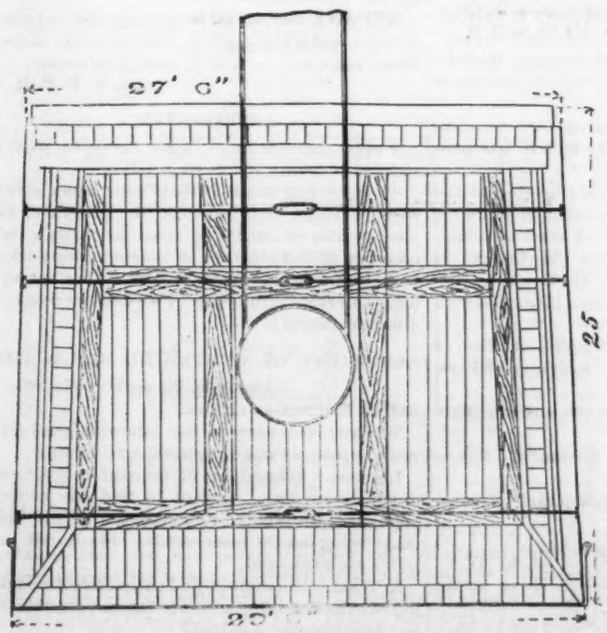

FIG. 6.—TRANSVERSE SECTION, NEW YORK CAISSON.

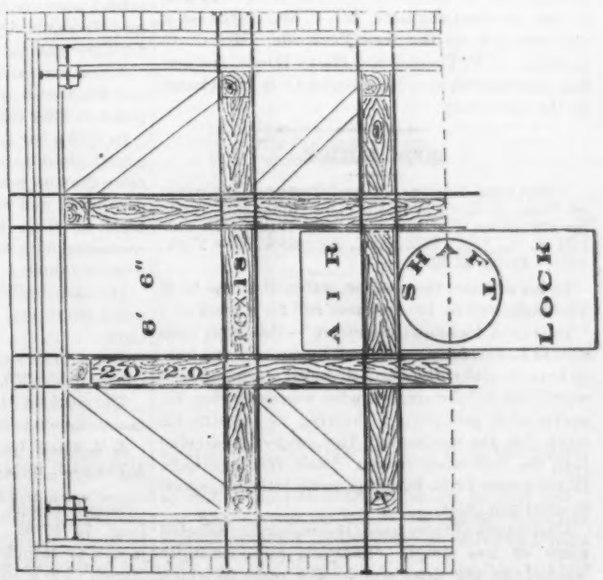

FIG. 7.—HALF PLAN, NEW YORK CAISSON.

edge of the loose filling around the old air-lock and top of the caisson, and the quicksand which was met in the bottom of the shaft and which also gave trouble while putting an invert in the caisson. Both of these (filling and sand) contained abundance of water, and the east heading being the lower it was feared, in the event of water breaking in freely, that the air-locks leading to this heading would become submerged, thus closing the only avenue of escape to some forty men who were engaged in pushing forward toward New York. During the entire work these men were not interrupted for one moment.

The work of sinking the caisson for the New York terminus is progressing most favorably. Much delay was occasioned at first by the remains of old dock-work, which most effectually interfered with the method of sinking. Figures 5, 6 and 7 show the manner of constructing the caisson so clearly that any detailed description would be superfluous.

Upon the top of the caisson is placed a weight sufficient to overcome the buoyancy, and which is increased as fast as demanded by the increased depth and side friction. When it is desired to sink the caisson a trench is dug under the shoe, varying in depth according to circumstances, and all obstacles, such as rocks or timbers, removed. The air pressure is then lowered, when the combined weight of the caisson and its load overcome the buoyancy of the water and it drops into place. No suspenders or guides—such as were used on the other side—are needed, the direction of the descent being kept vertical without them.

We are especially indebted to Mr. C. W. Raymond, assistant engineer on the New York side, for the loan of notes and drawings, and to Mr. C. C. Lovejoy for his courteous services as pilot through the intricacies of the New York caisson.

Gen. W. Sooy Smith and his son, C. S. Smith, are acting chief engineers of the work. Mr. S. H. Finch is first assistant engineer, Mr. C. W. Raymond is also assistant on the New York side. Mr. C. C. Lovejoy, G. P. Thomas and Harry Bowie are acting superintendents; Mr. Charles Clift has charge of the machinery.

BOOK NOTICE.

"Practical Lessons in Architectural Drawing; or, How to Make Working Drawings and Write Specifications for Buildings." By William B. Tuthill, A. M. 8vo. William T. Comstock, New York: 1881. Price, $2.50.

In his preface, the author states that the book was suggested by the frequent call for a work of a "restricted technical character"—this expression should be carefully considered by authors and publishers of other than architectural works—which would enable the student who was somewhat familiar with geometrical drawing to prepare his work for the mechanic. The subject is divided into the following heads: Small frame cottage, frame house, brick building, stone building, specification and color.

Under each of these heads the author has selected more or less simple examples, and carefully worked out the drawings in the order in which they are required in actual building, and, with the aid of concise and plain explanations in the text, has put the work in such shape as to be readily comprehended. These examples have been given as varied a character as possible in a book of this size.

The drawings are all of good size, plainly and neatly executed, and the dimensions and parts are fully explained in figures and letters which can be easily read.

A chapter has been devoted to specifications and a method of writing them.

The last chapter deals with coloring as applied to this class of drawings, and is illustrated by a plate in colors.

The book is well printed, upon a good quality of paper, and substantially bound. It will, undoubtedly, fill a gap which has long existed in kindred works.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.*

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 510.)

CLXVI.—AVON.

Avon, New York, in lat. 42° 55′ N., long. 77° 50′ W., is on the right bank of the Genesee River, on a terrace 100 ft. above the water.

Water-works were built in 1857 by a private company after the plans of McRee Swift, C. E., taking the supply from 10 or 12 springs, 2½ miles from the town. The water is collected in two reservoirs, one circular of 45 ft. diameter and 20 ft. deep, with the sides and bottom puddled with 2 ft. of clay and paved with cobble stones; the other 150 ft. square and 17 ft. deep, lined with clay puddle. The reservoirs are 300 ft. higher than the town. The supply main is a 4-in. wrought iron and cement pipe. The distribution is by 3 miles of wrought-iron and cement pipe of 4-in. 3-in. and 2-in. diameter, and 4 miles of gas pipe of ¾-in. and ½-in. diameter. There are 10 fire hydrants and 60 taps.

The population in 1880 was 1,600, and the estimated daily consumption 200,000 gallons.

The works cost $18,000 and the annual cost of maintenance is about $200. Stephen Hosmer was the Superintendent in 1878.

CLXVII.—EVANSTON.

Evanston, Illinois, in lat. 42° 5′ N., long. 87° 40′ W., is on Lake Michigan, 12 miles north of Chicago.

Water-works were built by the town in 1874, after plans of the Holly Manufacturing Company, taking water from the lake and pumping directly into the mains by a Holly engine and pumps of 2,000,000 gallons capacity.

A crib was built extending 125 ft. into the lake and filled with gravel, through which it was proposed to filter the water.

In 1876 a bar formed outside of the crib and the gravel silted up and it was impossible to pump for more than an hour at a time. A plate-iron box, perforated and filled with gravel, was then put in 1,600 ft. from the shore in 21-ft. water, and connected with the pump-well by a 16-in. pipe with flexible joints.

The distribution is by cast-iron pipe, of which 12 miles are in use, with 80 fire hydrants and 400 taps.

The population in 1880 was 4,820, and the daily consumption 300,000 gallons.

The works cost $40,000, and the annual cost of maintenance is $4,500.

J. R. Fitch, C. E., was the Superintendent in 1876 and J. Ebbert in 1878.

CLXVIII.—MAUCH CHUNK.

Mauch Chunk, Pennsylvania, in lat. 40° 55′ N., long. 75° 40′ W., is on the Lehigh River at the mouth of Mauch Chunk Creek. The two towns of Mauch Chunk and East Mauch Chunk are on steep hills on opposite sides of the Lehigh River.

In 1849 water-works were built by a private company, after the plans of E. A. Douglas, taking the supply from a spring 1¾ miles from the centre of the town, and conveying it in a 3-in. wooden pipe for 4,500 ft. to a small reservoir 143 ft. higher than the centre of the town at the Court-house, and 4,590 ft. distant from that point.

In 1855 a reservoir was built to collect some additional springs, and a 6-in. cast-iron pipe was substituted for the wooden one.

In 1861 the company supplied East Mauch Chunk from a small stream a mile from the town, and 80 ft. above it.

Distribution is by cast-iron pipe. The main from the reservoir is of 10-in. diameter, and the distributing pipe from 8-in. to 2-in. About 4 miles are in use, with 28 fire hydrants and 430 taps.

The works cost $25,000, and the annual cost of maintenance is about $750.

The population in 1880 was 5,608. The consumption is not known.

Robert Klotz was President of the company, and R. M. Brodhead the Superintendent.

CLXIX.—HOLLIDAYSBURG.

Hollidaysburg, Pennsylvania, in lat. 40° 30′ N., long. 78° 30′ W., is on the Juniata River, at the western foot of the Allegheny Range. For a number of years it was the point of transfer for passengers and freight from the canals to the inclined plane railroad over the mountain.

Water-works were built in 1867 by the borough after the plans of John Branley, taking the supply from Roaring Run, 3 miles from the town and 279 ft. above it, and conveying the water through a 6-in. Wyckoff wooden pipe. Distribution is by the same kind of pipe, of from 5-in. to 3-in. diameter. Eight miles are in use, with 45 fire hydrants. The number of taps is not given. The population in 1880 was 3,139.

The works cost $73,000. Prior to 1876 the cost of maintenance was $228 annually. In 1878 R. L. Howell was the Superintendent.

(TO BE CONTINUED.)

*Copyright 1881.

CORRESPONDENCE.

BEST STUMP PULLING MACHINE.

BEARMOUTH, Mont., Dec. 1, 1881.

EDITOR ENGINEERING NEWS:

Will you please inform me through your column as to the best stump pulling machines now in use Please address.

L. J. FISK, Contractor,
Care N. P. R. R.

APPRECIATED.

A CIVIL engineer and county surveyor from a California county writes us as follows:

"I enjoy very much getting your paper every week, and only wish you could do something toward *waking up* our Pacific coast surveyors to the necessity of united action in obtaining legislation to shut off *loose* and what I call *criminal* surveying. Our State is full of it. [We wish we could.—ED. ENG. NEWS.]

ALIGNMENT OF COMPLETED RAILROADS.

ANDOVER, N. J., Dec. 17, 1881.

EDITOR ENGINEERING NEWS:

Will you please answer the following questions through the columns of ENGINEERING NEWS?

1. I have a finished line of railroad the records of which are lost. I want to find the correct alignment, the points of intersection of the tangents being mostly inaccessible. Please tell me how I am to proceed.

2. What is the shortest and easiest rule for making out the deflecting distance for any number of feet less than one hundred?

Respectfully, F. MILLER.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

A meeting of the Society took place at their rooms, 127 East Twenty-third street, on Wednesday evening, Dec. 21, Mr. Ashbel Welch in the chair, on which occasion a paper was read by Mr. Hutton, C. E., on the flow of rivers subject to high freshets, and on the effects of the location of bridges on such streams in restricting the flow at such times, and the additional rise of water occasioned thereby, illustrated in the case of the

crossing of the Chemung River, in this State, about ten miles east of Elmira, by the Delaware, Lackawanna & Western Railroad, in proximity to the Erie Railroad, located in the valley of the same river. The case has been in litigation, and the evidence was taken before a commission of the Supreme Court (referred to briefly in ENGINEERING NEWS of Nov. 5).

Mr. Hutton gave a synopsis of the evidence and his views in relation to the proper method of calculation. This was followed by a discussion in which several of the members present took part, and while there was some diversity of opinion as to the precise value to be given to the numerical coefficient in the various formulæ used for flow of water in open channels as applicable to this case, yet there was a decided unanimity in the opinion that not only was there no known formula applicable to all rivers, but that from the nature of the case it was not likely that any formula could be developed for such cases which would preclude the exercise of the judgment of the engineer in the selection of a proper coefficient.

The subject is a fruitful one for discussion, and at some future meeting of the society will be further considered.

ENGINEERS' CLUB OF PHILADELPHIA.

DEC. 3, 1881.

This meeting was the first held in the new and handsome rooms, although they were only partially ready for occupancy.

President Strickland Kneass in the chair. Thirty members and one visitor present.

The resolution of the Board of Directors, authorizing the Secretary to sign the lease for these rooms, was reported and ratified by the club.

Officers were nominated to serve during the year 1882.

The matters of scientific interest presented were as follows:

Mr. John E. Codman exhibited drawings of and described Nicholson's Fire Escape, which consists of a fire-proof brick tower, octagonal externally and cylindrical internally, with central shaft about 18 in. diameter, around which is formed a winding passage, of a U-shaped section, 2 ft. 3 in. in width, with smooth or glazed surface, and inclined at angle of 35°, with retarding curves of less gradient. Fire-proof doors would connect with each floor and roof, and a vestibule with the surface of the ground below. It is intended that those escaping shall assume a sitting posture on entering the spiral and slide to the bottom, and it is claimed to be safer than other escapes for those unaccustomed to ladders, or weakened by fright and excitement.

Mr. Codman also exhibited a working model of Deschamp's Angular Shaft Coupler, by means of which shafting can be offsetted when bearings are displaced or bent to an angle, from 0° to 90°.

Prof. L. M. Haupt exhibited an Interpolating Scale, devised by Prof. W. S. Chaplin, of University of Tokio, Japan, by means of which any intermediate point of elevation between two known points, on a topographical plan, can be readily determined.

He also read a short discussion of Mr. S. C. Gant's scheme of underground railroads in Philadelphia, presented at last meeting. Prof. Haupt, while decidedly favoring rapid transit, and admitting the practicability of the construction proposed, considers Mr. Gant's estimate of cost entirely too low, and, by comparison with the Union Tunnel at Baltimore, he estimates that that portion of the tunnel system which Mr. Gant estimates at $1,733.710 would cost $6.051,500, or about three and one-half times the original estimate, and even this he considers too low for the plan proposed.

Prof. Haupt also read a paper upon railroad cross-ties, touching especially upon the desirability of an iron tie, a model of which he exhibited at the last meeting.

Mr. T. Earl Collins exhibited and described a model of the Cameron Valve Motion.

Mr. Wilfred Lewis exhibited a movable head T square, the head of which is held very firmly in position by means of a cone clutch.

Mr. Howard Murphy opened the proposed discussion upon passenger elevators by reading an account of the means and results of testing wire ropes and methods of attachment to cages, by Herr Baumann, translated in *Abstracts, Inst. C. E.*, vol. lxv., part iii., p. 53.

HOWARD MURPHY, Secretary and Treasurer.

PRECAUTIONS TO OBVIATE THE DANGERS OF ELECTRIC LIGHTING.*

It is scarcely necessary to commend the following to our readers, as it is a subject in which we are all so interested that anything from such a source commands attention:

The committee, to whom was referred the question of "the dangers incident to electric lighting, if any, and the means of overcoming them," respectfully report as follows, viz.:

That from a careful consideration of the evidence submitted they believe that the use of electricity as an illuminant, as now generally employed, is not attended with any dangers, either to person or property, that cannot be obviated by the adoption of the precautions hereinafter set forth.

In order that the reasons which give rise to the necessity for these precautions may be the more thoroughly understood by the general public, for whom they are designed, the committee believe that the following statements of the general principles involved in systems of electric lighting as now practiced, may not be amiss.

There are two systems of electric lighting now in general use, viz., the "incandescence system" and the "arc system."

In the "incandescence system" an electrical current, flowing through a thin wire of platinum, or other difficultly fusible metal, or through a thin filament of carbon, heats it by incandescence to nearly a white heat, by reason of the resistance it offers to the passage of the currents.

In the "arc system" an electrical current flowing from one rod of hard carbon to another, heats the rods sufficiently to cause a stream of carbon vapor to pass between them. This vapor, heated to intense whiteness by the electricity, forms what is known technically as the "voltaic arc."

In the "incadescence system" it is necessary, in order to prevent the rapid destruction of the wire, or carbon filament, to surround it completely by a glass globe or cover from which all the air has been removed. In this system, therefore, external objects cannot come into contact with the source of light.

In the "arc system" it is not necessary to exclude the atmospheric air from contact with the carbons, or electrodes as they are sometimes called. Arc lights are, therefore, burned in the open air. They are generally much brighter than incandescent lights, and are, in practice, usually surrounded by a globe of glass, in order to lessen the intensity of the glare. They can, however, be placed in a globe from which all the air has been removed, since the light produced is not dependent on the burning of the carbon electrodes—that is, on their combustion.

The source of the electricity employed in all systems of lighting is the dynamo-electric machine. This machine produces, more cheaply, a current whose properties are similar to the current obtained from the ordinary voltaic battery.

In the dynamo-electric machine, mechanical energy, derived from a steam engine, water wheel, or any other suitable source, is converted directly into electrical current. The change of mechanical into electrical energy is obtained by the motion, past powerful magnets, of a number of coils of insulated wire wrapped on a core of iron. The core so wrapped is called the armature. The armature moves close to the poles of the magnets already referred to, but does not actually touch them. There is, therefore, no friction in the dynamo-electric machine as in the ordinary electrical machine. The attraction of the magnet poles tends to hold the armature in fixed positions. Mechanical power is required to move it out of such positions, and when so exerted is converted into electrical currents which flow through the coils of wire on the armature.

The current in the armature flows alternately in different directions through the wire wound thereon. It is generally caused to flow constantly in one and the same direction by means of a contrivance called the commutator.

The current so produced flows out of the machine, through a conducting wire, into and through a number of lamps placed at suitable points in the lengths of the wire, and finally through a continuation of the wire back to the machine.

The path of the current from the machine to the lamp, and out of the lamp back again to the machine, is known technically as an "electric circuit."

Any conductor is said to be placed in an electric circuit, or to form part of an electric circuit, when it is so arranged that the current from the machine or battery causing the electricity can flow through it and back again to the place where the current was produced. That is, anything placed in an electric circuit forms part of the conducting path through which the current is circulating.

Dynamo-electric machines are now made to furnish very powerful currents; currents capable of sustaining fifty or more arc lights in one circuit or line. Such currents require care in their management, and judgment in their introduction into buildings or public places for purposes of illumination.

Fortunately, however, the currents produced by dynamo-electric machines have some properties very different from those produced by the ordinary frictional machine. The former possess little or no power of leaping from one conductor to another across an intervening non-conductor, such, for example, as air; the latter can, as is well known, readily so pass, often through several feet or more of dry air.

The currents from dynamo-electric machines, or the currents employed in systems of electric lighting, are not, therefore, at all comparable to strokes of lightning, to which they have often been ignorantly likened. Lightning discharges frequently pass through miles of air, but, even in the largest machines, the carbons employed in arc lamps must first be brought into contact and afterwards separated, before the arc is established and the current passes between them. The current will not, in fact, leap through the air. The momentary contact of the two carbons develops sufficient heat to form a cloud of carbon vapor between them, and this cloud, being an electrical conductor, permits the current to pass.

When, however, the cloud of vapor is once established between the two carbons, it will continue to pass until the carbons are sufficiently divided between the different paths in proportion to their conducting powers.

Suppose, now, that two different portions of an electrical circuit be bridged over by any conducting material. Say, for example, that a wire from a line of telegraph or telephone falls across a line of electrical conducting wires, so as to connect the wire carrying the current from the machine with a part of the wire carrying the current back to the machine. If such electrical conducting wire be uninsulated, a series of cross contacts would thus be formed, and two different paths be opened to the current. Since the conducting power of the short wire, forming the cross circuit, would probably be far greater than that of the portion of the circuit with its included lamp, the greater part of the current thus "cut out" or "short circuited" would pass through the cross wire, either fusing it, or drawing dangerous arcs of flame when the contacts were at times but partial.

This danger may be entirely obviated by insulating the wire. It is therefore preferable to insulate all parts of the wires that lead either from or to the machines producing the current.

As these arcs of flame are very hot, their occurrence should be carefully prevented in all places except between the carbon electrodes in the lamp.

Dangers of this character may be entirely avoided by carefully insulating all the wires which carry the electrical current into or out of the building or space to be lighted.

The comparatively feeble leaping power of the currents developed by dynamo-electric machines, as already referred to, does not, however, necessitate any very high degree of insulation for the wires. Whatever the character of the insulation employed, care should be exercised to insure its being preserved intact on all parts of the wire. The removal of the insulation from but a few points of the wire might cause a dangerous discharge at such points.

When two different paths are open to the current, it will flow through both such paths. If these paths are of different conducting powers, more current will flow through the path which is the better conductor. If one of the paths be twice as good a conductor as the other, twice as much current will flow through it. If it be a hundred times a better conductor, a hundred times more current will flow through it; and so for any other proportion. In other words, the currents will be consumed to cause the distance between them to become too great to be bridged over by the vapor. While, therefore, the current possesses little or no power of so leaping through air, yet it is necessary that no opportunity be afforded it to form such conducting clouds between it and neighboring conductors. A brief

* Report of the committee of the Franklin Institute Dec. 5, 1881, on the precautions to be taken to obviate the dangers that may arise from systems of electric lighting.

mention of some of the ways in which such clouds may be formed will, therefore, be of practical importance.

If two bare metallic wires, conveying powerful electrical currents from different sources, be brought into contact and then gently separated, a cloud of metallic vapor may be formed between them, as in the case of the carbon electrodes.

Or if any portion of a bare wire be brought into contact with one part of a metallic conductor, and a distant part of the same wire again touches this conductor, an arc of flame may be established between the wire and the conductor.

To speak more generally, if any conducting material be placed in, or form a part of the electrical circuit, and from any cause a momentary break be made between it and the rest of the circuit, an arc of flame may result.

If the human body be accidentally placed in the circuit, the partial or entire passage of the current through it may, if the machine be powerful, cause instant death, or, if the machine be of smaller size, produce a painful shock.

But to enable the current so to pass, the body must be placed in the circuit of the machine; that is, the current must be able to enter the body at one point and to pass out and back to the circuit from another point, or, in other words, a break must be made in the wire, and the body inserted in this break.

Here again the difference between the current from dynamo-electric machines and from the common frictional machine, is to be carefully noted. Merely touching any part of a charged conductor of a frictional electrical machine will completely discharge it, the person conducting the discharge through his body to the ground. A person touching any part of a bare conducting wire, while it is conveying a powerful electrical current, such as is used in systems of lighting, would not convey the discharge through his body to the ground, because he would not be placed in the circuit. He has simply provided a place for the current to enter, but none for it to flow through him and back to the machine whence it originated.

Should, however, one portion of the wire touch the ground in any place, especially where it is wet, then his feet might be connected through the damp ground with another part of the circuit, and two paths be opened to the current, with the chances of a dangerous portion thereof passing through his body.

To guard against dangers of this character it is necessary to thoroughly insulate the wire in all places where it is liable to be touched. It is far preferable to establish a continuous metallic line of conductors both to and from the machine, rather than ground the wires, and so necessitate the current to pass through the earth in order to flow back to the machine.

During the burning of lamps of the arc type fragments of highly heated carbon sometimes become splintered from the electrodes and fall below. To avoid danger from this source a cup should be placed below the electrodes to receive any fragments that may fall.

It would follow, from the principles thus briefly enunciated, that there may arise two kinds of dangers from the employment of powerful electrical currents for the purposes of artificial illumination, viz.: Dangers to property from fire; and dangers to life. With the exception of that due to falling fragments all these dangers may be readily and completely avoided by properly and thoroughly insulating the wires that carry the current to and from the machine, while that due to falling fragments may be easily avoided by the means above pointed out.

In order, however, to particularize these different kinds of dangers, and to point out more especially the proper remedy for the avoidance thereof, the committee recommend that the following precautions be taken in all cases where electric lighting is employed, viz.:

1st. That the conducting wires leading into and out of the building be suitably insulated throughout their entire extent, both to and from the machine producing the current.

2d. That an inspection be made at suitable intervals to determine whether or not the insulation has been preserved intact.

The insulation may become impaired by the following causes, viz.:

By the wires being cut by the staples or hooks used in securing the conducting wires in position.

By the wires being placed in positions subject to abrasion, either by chafing with another wire or from any other cause.

By the wires turning sharp bends, or by being sharply bent by any cause whatever.

3d. That conductors formed of numerous short pieces of wire be avoided as far as possible, and that where their use is necessary the joined ends be made as secure as possible by wrapping, so as to prevent short arcs being formed at imperfect junctions, should the joined ends be partially separated from each other.

4th. That the wires be not grounded; that is, that no attempt be made to cause the current to pass back to the machine through the earth, but that a continuous line of wire be provided, through which the current shall so return.

In order that this precaution may be effective, the wires should not be carried near metallic bodies like lines of shafting, nor gas nor water pipes, because an accidental contact of the conductor with any of these would effectually ground that part of the wire. Where it is necessary that the wire cross such metallic bodies, it is advisable that the insulation be made better than usual at such junctions.

5th. That the ready occurrence of cross contacts or short circuits be avoided, as follows, viz.:

That the conducting wires from different machines, or from different parts of the same machine, be kept as far apart as convenient, and never, except when necessary, be brought nearer together than the distance between the two binding-posts on any electric lamp used in the circuit.

That therefore the wire leading from the machine into the room to be lighted should leave the room as far as convenient from the place it enters.

That the wires be securely fixed in position and be not allowed to sag or bend in wide curves, except where it is necessary to permit the raising or lowering of the lamp.

That judgment be exercised in selecting the portions of the building in which to run the wires. To secure as far as possible the absence of moisture, ceilings are to be preferred to walls or floors, the latter being highly objectionable, unless the wires are placed under the flooring. As before stated, the location selected should be removed as far as possible from metallic conductors. Select the places least liable to be rendered partially conducting by moisture from any source, in which to run the wires.

6th. That the conducting wires be of sufficient size to carry the most powerful current employed without dangerous heating.

7th. To avoid the danger to life from the accidental discharge of the current through the body, the conducting wires should in all cases convenient be placed out of reach, either by choice of location or the use of heavy and guarded insulation.

8th. That where lamps of the arc type are used, they be covered with a globe of glass, and that the lower end of such globes be furnished with a cup or pan for retaining any heated fragments.

The committee believe that if these precautions be taken, electric lighting can be thoroughly safe and reliable, and that all dangers attending its use can be entirely obviated.

R. E. Rogers, M.D., Chairman.
Charles M. Cresson, M.D.
David Brooks.
E. Alex. Scott.
Edwin J. Houston.
Isaac Norris, M.D., Secretary.

PRACTICAL SCIENCE IN ENGLAND AND ABROAD.

WHAT AN ENGLISHMAN SAYS OF US.

The industrial energy of the United States affords an example which may be advantageously followed in Europe. It is a matter of some wonder to those of us who can remember the railway system in its cradle, and who are personally aware of the immense start which, five-and-twenty years ago, the forges, the factories, and the railways of England had and held over those of Continental Europe, to see how the spirit of enterprise has spread its wings from our shores. It is to Berlin that one great electrician goes to carry first into practical effect his electric railway. It is from the Alps that the first practical experience, so precious to a mining people like ourselves, in mechanical rock-cutting, and in the application of compressed air to the purposes of mining, is to be derived. And now, in that last new development of the doctrine of the convertibility of the physical forces—lighting by dynamic energy—we find ourselves at a distance behind the United States such as must be measured rather in fractions of a century than in portions of a year.

A glance at the map of the United States, with its straight lines of demarcation, so different from these afforded by either the political or the physical geography of the older world, may serve to impress the imagination with a sense of the rapidity with which scientific invention is carried into practical use in America. From Albany to Great Salt Lake is a distance of 38° of longitude. From New York to New Orleans is a distance of 12° of latitude; Akron (in Ohio), Wabash (in Indiana), Denver (in Colorado), lie wider apart than do Paris, Brussels and Berlin. From each of these distant points, in one single, and, so to speak, casual, letter from an American interested in the progress of electricity, comes the same story. We regard with a mixture of pride and wonder the few experimental steps which, chiefly at the risk of French, and partly of English speculators, have been taken toward lighting parts of London and some other towns by electricity. Neither in England nor on the Continent have there yet been established general lighting stations, to supply electric light after the fashion of gas-works. In the United States, we are told, "no considerable city is without such an institution." At Salt Lake City an arc-light company has for some months supplied electric light to miscellaneous customers. In Denver, Col., a city of 35,000 inhabitants, above 200 arc-lights are supplied to shops, hotels, etc., by a company; the light in each case being furnished at from 20 per cent to 30 per cent below the price of gas, as well as being much greater in quantity. The Salt Lake company is said to have been the first in the world to supply electric light in direct competition with gas. The returns to the proprietors are lucrative in each case.

The subject is attacked in America precisely as, thirty or forty years ago, the manufacture of gas was introduced into our smaller towns. A local company is formed, which, of course, has the advantage of the experience attained up to the latest hour. A concession from the patentees of the system chosen is arranged for. Ground is bought, buildings are erected, and engines, boilers, dynamo-machines, and the whole light-producing apparatus are purchased and erected. Powerful engines are employed, with fly-wheels weighing from eight to ten tons, in order to have steadiness and uniformity of motion, the absence of which is evinced by that flitting, fire-like pulsation of light with which we have become familiar on the banks of the Thames. We have not heard of the application of water-power to the service, but of its adaptability near some of the great rivers of America there can be no doubt. Wires are conducted either under or over the streets, to be tapped where required, in the same manner as gas-mains. Automatic contrivances, for the purpose of turning light on and off at pleasure, are supplied with the lamps, which are visited and kept in order by the servants of the company. The result appears to be the advance of electric lighting all along the line.

The use of masts or towers of the height of 200 feet for the lighting of squares and streets is becoming general. The city of Denver is lighted from lofty towers, and for the price formerly paid for gas four times the area is now lighted by electricity. In the city of Albany 300 electric lights, placed on alternate blocks, have replaced some 2,000 gas and oil lamps. Akron, in Ohio, is lighted from towers; and Wabash, Ohio, by four lights on the steeple of the court-house. In New York there are competing companies, one of which is now supplying 1,000 lights to shops, and is providing for 4,000 more. Most original of all is the application of this source of illumination at New Orleans. In the fever-haunted delta of the Mississippi the comparative coolness of the night is now selected for running the races of the Jockey Club by the light of electricity.

The tariff of the American light companies charges a fixed annual sum for electro-motive power, according to the number of hours for which it is supplied. The companies provide and maintain the lamps; the consumers supply their own carbons. The average price is about £80 per annum for a 2,000-candle light, which is equal to 125 gas lights of 16 candles each. A shop requiring twenty gas-burners would be better lighted by an arc-light of the strength of 100 gas jets. In giving this—the electric light companies' statement—it must, however, be remembered that for many purposes number and nearness of lights will be more important than actual quantity of light radiated from a single point. As to this, however, we can only oppose scientific scepticism to actual practice. The Americans seem to have found out, in spite of the inconvenience of single points of illumination, that they are on the right track.

The above article from the *Builder* closes with

the suggestion that a commission be sent to this country to examine and report upon the subject of the American electric-lighted cities, which would be regarded as a professional paper of the first importance.

GENERAL INTELLIGENCE.

☞ *We solicit and are always pleased to publish in these columns any items of interest that may be furnished us.*

GAS AND WATER.

Decorah, Iowa, has completed new water-works.

Water was turned on in Dedham, Mass., last week, the new water-works being in readiness to supply the people.

The American Water-Works Association meet in Columbus, O., on the second Thursday of March, 1882; J. H. Decker, Secretary, Hannibal, Mo.

The Lee, Mass., Water Company has built a dam above the one from which the village water supply is drawn, as a storage reservoir for next summer, and it will hold 12,000,000 gallons.

The water-works at Abilene, Kansas, are progressing as rapidly as can be expected when the delay of material by the railways is the chief cause. If no further delays are experienced the contractors expect to have the works finished by Jan. 15.

The superintendent of lamps, Boston, has been instructed by the City Council to place as many electric lights in the principal thoroughfares as he shall deem proper, provided the expense shall not exceed 65 cents per lamp per night.

J. A. Richardson, who has proposed to build water-works for Fort Worth, Texas, has increased his estimate to $80,000. It is now thought that the committee appointed by the council to consider his proposition will report adversely.

Col. John H. Bergen has begun a suit on behalf of the devisees of Susan Catin (the family of the late General P. S. Crooke) against the Flatbush (Long Island) Water works Company, to compel it to take off pipes laid by it in Clarkson avenue, in Flatbush, to enjoin it from using the pipes and for $5,000 damages. The ground on which the suit is begun is that the company has never paid a dollar for the use of the land, or got permission from the owners to use it, and that the pipes are an additional burden and compel the owners to pay a sewer assessment.

The Fond du Lac, Wis., Common Council Dec. 15 resolved to adopt the electric light, and appointed a committee to perfect the arrangements for lighting the city from four towers. The attorney for the gas company was present and addressed the council, giving notice that the company claimed a vested right to light the city, and would seek to enforce its rights. A remonstrance against making the experiment of the electric light, signed by some of the heaviest taxpayers in the city, was also presented to the council. Litigation will undoubtedly arise from the proceedings.

JOLIET, Ill., Dec. 17.—The water-works question is at last practically settled. Jesse W. Starr, Jr., builder of water-works, came here from Louisville, Ky., where he had just put in a system, and closed a contract with the Joliet council for a similar system. It has been finished for the past two months, and, in the meantime, the city has divided into factions for and against accepting the works. The company was to throw water from five hydrants at one time one hundred feet high. They have made two tests and failed, and the council, at its meeting, refused to accept the works. The following resolutions were passed at the council meeting.

Resolved, That forasmuch as the said Jesse W. Starr, Jr., has failed and neglected and refused to construct the said water-works as he had agreed to in the said contract and the supplemental contracts, in the particulars designated in the preamble, and in other particulars not therein nor herein particularly described and set forth and set out, the said city of Joliet does hereby refuse to accept the said water-works, or any part thereof, and be it further

Resolved, That all rights and franchises granted to the said Jesse W. Starr, Jr., his successors or assigns, be and the same are hereby revoked, determined and forfeited; and be it further

Resolved, That the said contract by and between the said Jesse W. Starr, Jr., and the said city of Joliet, and all supplemental contracts referred to in the preamble or resolution be and the same are hereby declared determined, forfeited and amended.—*Chicago Times.*

Mr. Nelson G. Green, of New York City, in a report on the Springfield, Mass., Water Supply, remarks that water once contaminated or rendered favorable to the growth of lower organisms can never again be purified and will continue to contain the deadliest of poisons. Stagnant water like that in the Ludlow reservoir last summer is found to be the most liable to foster dangerous germs, which become active parasites when received into the human system. Stagnant pond water especially abounds in hydatids, so minute that hundreds may exist in a glass of the liquid unobserved by the naked eye. Any one of them on gaining access to the stomach endangers and always shortens human life. Embryos of as many as three specimens of tape-worm have been found in no worse water than the Ludlow, and of a class which are particularly anxious to work their way to the brain, many deaths being annually attributed to them. It has been said that the Ludlow water is purified by the winter weather, but this theory is pronounced false. The water is even considered worse, as the gases which can escape in the summer from the entire surface are sealed up in the winter by the ice and are absorbed to a much greater extent by the water. It is said that at the Ludlow reservoir a bad odor is very preceptible on breaking a hole in the ice. In the light of Mr. Green's investigations, also, our water commissioners appear singularly inconsistent in their expressed opinion that Ludlow water is better than that from the dug wells of the city. This, Mr. Green says, proves nothing, since the average dug well, wedged in among out-houses and stables and in a porous soil, is little better than a cesspool.—*Republican.*

An incident in the history of a New York family has served to explain a matter which many persons have found interesting, but incomprehensible. General Sickles, lately Minister of the United States to Spain, returned not long ago from a four months' trip to Europe, and although his house had been closed during the whole period, he found a bill awaiting him from the gas company for four thousand feet of gas which had been consumed in his absence. Suspecting, very naturally, that some mistake had been made, he refused to pay the bill, and when the gas company sent men to enforce its demands by taking out the meter, he was obliged to obtain an injunction from a court to restrain them. The solution of the mystery is given by a correspondent of the Indianapolis *News*, who suggests that as all gas-meters are constructed to register only a flow of gas in one direction, without noting a back flow, if such should occur, anything which occasioned a variation of pressure in the mains would alternately force gas through the meter into the house pipes, and then, when the pressure was relieved, would allow it to return again to the mains, moving the index of the meter forward at each successive impulse, without any corresponding consumption at the burners, and without any return of the index upon the retreat of the gas to the street pipes. During the manufacture of the gas the pressure in the pipes is for some reason varied, while at night the closing of the theatres or other places which consume large quantities of gas is indicated at a considerable distance in every direction by a sudden increase of pressure and flaring of the house jets which still remain lighted. From all these causes it is probable that house meters usually register a larger quantity of gas than actually passes through them, and the remedy suggested by the correspondent of the *News*, that the gas should be shut off at its entrance into the building, beyond the meter, whenever it is to be for some time out of use, is worthy of being remembered. It has been a standing imputation on the female housekeeper that she never could be made to understand, that so much gas had been consumed the previous month. She is sure there must be some mistake in reading the meter, and the explanation that the next month would rectify it is always taken with misgivings of its truth. Will some one learned in gas matters inform us whether the ordinary meter can register this back flow in the manner suggested by the "*News* ?"

CORRECTION.—Office of the Warren Foundry and Machine Co., Manufacturers of Cast-Iron Gas and Water Pipe, 153 Broadway, New York, Dec. 12, 1881.—*Editor Engineering News:* Will you please inform me where or from whom you obtained the item in your last issue stating that Hornellsville, N. Y., has contracted with us, etc., etc. In your next issue, under head of "Gas and Water," I request that you deny the statement in toto, also add that the Warren Foundry and Machine Company *never* take contracts of that kind.

Yours truly, WM. RUNKLE.

The item was published verbatim as sent us by our traveling agent, who quoted Mr. J. W. Near, President of the Hornellsville city government and a member of the law firm of Near & Platt. Before acceding to Mr. Runkle's request, we wrote Mr. Near for the facts in the case, and he replied on the 17th that he stated to Mr. Tuckerman "that an application had been made to the authorities of this place (Hornellsville) by J. M. Low, William Runkle, of New York City, and a number of citizens of this place for permission to organize a water-works company and to lay mains and pipes in the streets, etc., for the purpose of supplying this place with water; that the application had been granted substantially on the terms contained in your paper of the 10th inst. I said to him that no contract beyond the granting of this application had been made. No company has yet been formed; engineers are now making a survey and estimate of the cost. When this is ascertained, I am informed a company will be organized for the purpose of said application. I said to Mr. T. that I understood that Mr. Runkle, of New York, was the responsible man in the enterprise." Our agent has made a mistake in associating the Warren Foundry & Machine Co. with the matter, which the above statement of Mr. Runkle will render impossible in the future. We will endeavor to keep our readers posted on the progress of water-works construction in Hornellsville, and wherever else we get even the faintest hint of. That is a part of our business, and a very important part, too.—ED. ENG. NEWS.]

ELECTRICITY.

The Brush Electric Light Company, of Cleveland, are erecting three immense iron masts for lighting the city by their light. One is located in the center of the public square and will be 250 ft. high, 36 in. in diameter at the foot, tapering to 8 in. at the top, and will probably have six lights of 6,000 candle power; the other two will be located in relation to the first at equidistant points, so as to inclose a triangular space. The object of this is to illustrate the combined effect of a group of lights over a thickly built up part of the city. If this scheme is feasible they propose to illuminate the whole city in this manner.

STREETS, DRAINAGE, ETC.

The City Engineer of Pittsburgh, Pa., has submitted plans for a system wherein the main sewers will follow Negley's and Two-Mile Run, the first to drain 2,548 acres and the latter 1,800 acres.

BRIDGES.

The contract for an iron bridge over Cold River, in Acworth, N. H., has been awarded to the Corrugated Metal Co., of East Berlin, Conn.

The Clarke Bridge Company, of Baltimore, have work on hand at present as follows: A bridge, 1,050 ft. long, in six fixed spans and one draw-span, across the Savannah River, for the C. & S. R. R.; four 145 ft. spans for the E. T., V. & G. R. R.; two 125 ft. spans for the R. & A. R. R., in Richmond; one 150 ft. span for the W. & W. R. R.; two spans for the A. & N. W. R. R., one span for the C. & O. R. R., in West Virginia, and six spans for W. Md. Also about two miles of heavy trestle and over fifty Howe truss bridges for the New River R. R.

One of the largest bridges in the country is now in process of construction for the New York, Ontario & Western Railroad. It will be 1,300 feet long and 150 feet high. The bridge will be built of iron and will be about 380 feet longer than the great suspension bridge at Niagara and about 25 feet higher than High Bridge over the Harlem River, though 260 feet shorter. It will be a few feet higher than the New York and Brooklyn bridge and also 232 feet longer than the famous new London bridge over the Thames. As yet only one abutment is completed; the other requires 15 feet more of masonry, and the piers are but just begun. The work will continue through the winter.

RAILROADS.

The canals of New York have profited that State $50,000,000 in net earnings.

A black walnut grove that was planted by a Wisconsin farmer about twenty years ago on some waste land was recently sold for $27,000. The trees are now from sixteen to twenty inches through.

The stocks of the Denver & Rio Grande and of the Mexican National Railway and Construction companies had a serious set back last week and occasioned a considerable ripple of excitement in financial circles.

Winterset *Madisonian*, Dec. 14: A large number of ties for the Narrow Gauge are being got out along Clanton Creek. Ties are being delivered at St. Charles at 40 cents per tie; 2½ cents per tie are paid for hauling them. There are 10,000 ties piled up at St. Charles.

The *Railroad Gazette* reports for last week a total of 370 miles of new railroad, making 7,353 miles this year, against 5,624 miles reported at the corresponding time in 1880, 3,445 miles in 1879, 2,207 miles in 1878, 1,877 miles in 1877, 2 177 miles in 1876, 1,297 miles in 1875, 1,767 miles in 1874, 3,507 miles in 1873, and 6,885 miles in 1872.

The N. Y. Central R. R. freight business has grown from 3,190,840 tons in 1869 to 11,591,379 tons in 1881; at the same time its charges have decreased from 2.38 cents 6per ton per mile moved to .74 cents per mile; there are 15,000 employés; there are 23,000 freight cars, 00 passenger cars and 638 engines; on some parts of theroad 60 trains pass each way daily over its four steel tracks.

About twenty leading manufacturers of Illinois adopted resolutions on the 20th, at Chicago, on the action of the State Railroad Commissioners in fixing uniform rail rates, requiring railroad companies to charge large patrons exactly the same price per car as small ones. They declare that this action will drive from the State $20,000,000 of business, and that they will combine against this unjust discrimination if necessary by taking political action.

LAREDO, Dec. 15.—The track-layers of the Missouri, Kansas & Texas extension completed the laying of the line to the limits of this city to-day. This gives an unbroken direct line of railway from the Mississippi at St. Louis to the Rio Grande at Laredo, making a through line of about 1,300 miles in length. The Southwestern system undertaken by Mr. Gould a little more than a year ago has now been completed from the Mississippi at St. Louis to three points—New Orleans near the Gulf; El Paso, on the frontier of New Mexico, and Laredo, about half way between these two.

El Paso, Texas, looks like a Mexican town, but pretty well Americanized. Paso del Norte, immediately opposite, on the south bank of the Rio Grande, is thoroughly Mexican. The town takes its name ("the pass on the north") from the fact that the river can

forded here, but no other place within a hundred miles, and also on account of being a good wagon pass through the mountains. Some Yankees have just completed a bridge and are making piles of money collecting tolls from teams and footmen. It seems strange that the Mexicans would go all these years without a bridge when one could be built for $1,000.

Many curious things attract the notice of "a man from the States." The air is clear, and cigars get so dry as to be useless. The finest Havana cigars cost about the same as common ones in Topeka; beer, in very small glasses, two for a quarter. The Mexicans get their wood by digging, and the best water is on the highest lands. When they go to cut hay they take a hoe and dig it up. Ox-carts have heavy wheels made of three pieces, one piece about 4 ft. long and 2 wide, with ends rounded, and two short pieces of "fellows" fastened on to complete the circle.—*Topeka Capital.*

Many fear that we are building railways too fast. Yet a careful statistician, Mr. Edward Atkinson, is not frightened at the fact that we have already nearly 100,000 miles, but believes that in the next sixteen years we will have added 100,000 miles more. This would be an average of a little over 6,000 miles of new road per year, while we are building this year nearer 10,000 miles. Averaging the cost per mile at $35,000, Mr. Atkinson estimates that each 100 miles requires the service of 5,600 men for a year, and that to build 100,000 miles in sixteen years will require the continuous employment of 350,000 men.

Mexico is now reached by an American railway line. The construction forces of the system are now rapidly concentrating at this point to commence the great work of pushing on 700 miles further to the City of Mexico. The engineers who have had this part of the work in charge have completed their preliminary report. It is very favorable. The line will run through a rich mining and agricultural country. Extensive deposits of coal have been found on the line of the road, and such arrangements are making that a standard-gauge railway line to be operated by the Missouri Pacific Company from St. Louis through to the City of Mexico, 2,000 miles in length, may be expected to be completed and in operation in eighteen months from this time.

The last rail of the Decatur, Marquette & Northern Railroad, running between Marquette, Mich., and the Straits of Mackinac, was laid on the 9th inst. The line runs through an unbroken wilderness. When Superintendent and Chief Engineer Thomas M'Keown and C. S. Musson, resident engineer of the road, had occasion to inspect the line located by the engineers, one year ago, they were hauled over the right of way by a dog team, that being the only mode of transportation available in the then condition of the route. The preliminary survey of the road was commenced in the fall of 1879, and the work of construction was begun the next winter. For the purposes of construction it was divided into western and eastern divisions, and work was commenced simultaneously on both—at the Marquette end on the western division, and at St. Ignace on the eastern division, McDermid & Hendric being the contractors on the former, and John D. McDonald on the latter. Since that time work has been most vigorously pushed through all seasons of the year, and under all conditions of weather, until now, the task is finished, and the iron horse traverses without obstruction the wilderness of forest, thicket and swamp, through which one year ago a light sleigh drawn by dogs was the only means of conveyance. The length of the line is 152 miles, 60 of which lies through swamps. In one place, for a stretch of ten miles, the road is built through a marsh that presented an almost insuperable obstacle to its progress last fall, in consequence of the heavy rains. Great difficulty was experienced in getting supplies through to the workmen, particularly from St. Ignace, on the eastern division. The pluck of the officers of the road triumphed, however, over all they had to contend against, though unforseen difficulties delayed the opening fully three months later than was expected last spring. Track-laying commenced at Marquette, on the Western division, and at St. Ignace, on the other, in June, 1880, and on the 9th the rails were joined at Newberry Station, ninety-five miles from Marquette. The road is well equipped with rolling stock, and will be in superb condition for business by the opening of navigation next spring. The connecting Michigan Central line will be extended to the straits on the other side within a few weeks, when the new route to the east will become an accomplished fact. The company is now having ore docks built at Point St. Ignace, with a capacity of eight thousand tons, and will be prepared to compete for its share of the ore-carrying trade another season.

RIVERS AND HARBORS.

HARLEM CANAL.—In response to Senate resolution of the 14th inst., the Secretary of War transmitted to the Senate on the 19th a copy of the report of Col. John R. Newton, Corps of Engineers, upon the completion of the survey of Harlem River, New York, and through the Harlem Kills to East River, New York. The report was embraced in Gen. Wright's report to the Secretary of War on the 8th of October. It submits estimates of cost for a channel 300 ft. wide and 3,400 ft. long, and for 18, 15 and 12 ft. depth. For the former, $3,484,400; for 15 ft., $2,204,409, and for 12 ft. $1,161,225. The report recommends a depth of 15 ft. as sufficient for the purposes of navigation.

THE JETTIES.—NEW ORLEANS, Dec. 13.—At the last meeting of the Chamber of Commerce a committee was appointed to investigate and report on the depth of water and facilities for the promotion of the commerce of the city. Accompanying the committee on their investigation were Captain Leathers and John Cowden, strong opponents of the jetties, and their engineer, Benjamin McLain; Captain Eads and the United States engineers also had representatives. They anchored the boat on which the committee was, and soundings—thorough soundings—were taken at all points in the jetties and over the bar. Captain Cowden held one of the leads, and Mr. John Henderson, chairman of the Chamber of Commerce Committee, took down his figures, which were accepted by the committee. The report of the committee was made public to-day, the general results of its labors being summed up in the following paragraph, which I extract: "Your committee continued to make soundings through the jetties and across the bar at the mouth of the river, on the bar and outside of the bar in the gulf, and at no place found less than twenty-six feet of water in the channel and across the bar." The committee explains that when the soundings were taken the water in the jetties was fourteen inches below the average flood-tide.

REPORT OF THE COMMISSION.

WASHINGTON, Dec. 15.—The Senate to-day received from the Secretary of War the annual report of the Mississippi River Commission. It covers the progress made in surveys and examinations from the date of the last report, Jan. 8, 1881, up to Oct. 10, 1881. During this period triangulation of the river has been completed from Arkansas City, Ark., to Greenville, Miss., where it joins the coast survey. The river is not triangulated from Keokuk, Ia., to the Gulf of Mexico. The lines of precise levels are complete between Keokuk and New Orleans. With the remainder of the present appropriation it is hoped during the coming year to complete the final topography and hydrography from St. Louis to Vicksburg and complete the work of ascertaining the lines of levels across the alluvial bottoms of the Mississippi. The commission report they have expended $144,000 for surveys from Dec. 11, 1880, to Nov. 19, 1881, and have a balance of appropriations on hand of $111,000, which, it is thought, will be expended during the remainder of the current year, ending June 30, 1882. The estimates for the next fiscal year for surveys, etc., call for $200,000. The works of improvement contemplated under the existing appropriations include channel improvements upon two reaches, the first lying between Cairo and Memphis, a distance of 145 miles, to the second, between Skipwith's Landing, La., and Island No. 95, a distance of 25 miles. It is the unanimous opinion of the committee that improvement and navigation of the Mississippi below Cairo upon the general plan recommended in their report of Feb. 17, 1880, is entirely practicable, and that completion of the work for which partial estimates were then submitted will establish a continuous low-river channel, not less than 10 ft. deep, over all shoals and bars between Cairo and the head of the passes, with the possibility of attaining practical depths considerably beyond that limit. The commission estimates the total cost of improvements needed in the Mississippi at $33,000,000. Of the $1,000,000 appropriated by the act of March 3, 1881, $250,000 had been expended up to Nov. 25, 1881, and the remainder, $750,000, will, it is thought, be expended during the present fiscal year. For the next fiscal year $3,113,000 is asked, to construct a channel and protect caving banks on six reaches of river, 184 miles in length, and $1,010,000 for closing existing gaps in the levees.

On the subject of the levee system the commission repeat the conclusions submitted in their report of February, 1880, in which they say, among other things, that in the restricted sense, as auxiliary to the plan of channel improvement only, construction and maintenance of the levee system is not demanded, but in the larger sense, as embracing not only beneficial effects upon the channel, but as protection against destructive floods, the levee system is essential, and would also promote and facilitate commerce, trade and postal service. The commission renew the recommendation contained in the former report, that provision be made by law for appropriations of land or material when needed in the improvement of the river and not otherwise obtainable. It is recommended that authority be given the commission, or person in charge of work, to apply to the United States District Courts for condemnation of land or material and assessment of damage to owner. In addition to such legislation it is recommended that Congress declare to what extent river shall be under control of the commission during progress of the work, and under what circumstances and to what extent material found on bars and islands within the banks may be used without compensation to riparian owners. The control of reclaimed land, that willows, etc., may be planted to carry it up by deposit to high-water mark, is considered essential. The same is true in relation to the grade of service which may be given to the caving of the banks. Protection by suitable legislation to boats, machines, tools, etc, required for the work, is also suggested.

NEW PROJECTS.

There is a corps of engineers in the field now surveying a line from Dallas to this place for the Texas & St. Louis Railroad.

The Chicago, Mount Vernon & Southern Railroad Company of Illinois filed articles of incorporation Dec. 19. Capital $3,000,000.

GREENVILLE, Tex., Dec. 15.—A large force is now at work on the East Line Railroad, between here and Farmersville. The whole line is under contract. About one-third of the line is graded, and track-laying will begin in a few days. Large quantities of rails are being daily received here.

William Bannerman returned to Winnipeg on the 19th inst. with the remainder of the party employed in surveying the route of the proposed railroad to Hudson Bay. He is sanguine in regard to the enterprise. Active preparations will be commenced early next year. The Air Line Canada Pacific Railway has been completed between Winnipeg and Portage La Prairie. The road was officially opened on the 20th.

An English company has bought 2,000,000 acres of Florida lands from Mr. Hamilton Disston, of Philadelphia. Sir Edward J. Reed, member of Parliament, who is the representative of the purchasers, is a wealthy Englishman who has large interests in America, and who is engaged in building the Atlantic & Gulf Coast & West India Transit Railway, which runs from Fernandina to Cedar Keys, in Florida. On the consummation of the purchase, he and his friends started immediately for Florida, where they will at once organize a land company, whose headquarters will be in England. This company will be conducted in connection with the railroad companies, and it is expected the land will be settled rapidly by English and Dutch emigrants.

The details of the new scheme of a new air line railroad between Boston and New York, hinted at from time to time, and in the interest of which several of the engineering parties in the field the past few months are said to have been, are made public. The entire survey, it is stated, is now completed between Charles street, Boston, and Mount Vernon, Westchester County, N. Y., 12 miles from the Grand Central Depot. The distance of the new road to be built to its connection with the Harlem is 177.33 miles. The line as surveyed begins at Charles street, Boston, crosses Beacon street at the junction of Brookline avenue, crossing the Boston and Albany Railroad at nearly right angles, passing through the southerly part of Brookline, and from there Needham, Dover, Midway, Milford, Northbridge, near Whitings in Uxbridge, and Douglass, in Massachusetts. From thence through Putnam, north of Willimantic, Middletown, Wallingford, and Birmingham, in Connecticut, to the State line of New York, in the town of Rye. Thence direct to Mount Vernon, about 12 miles distant. The surveys show about seven tunnels, with an aggregate length of about five miles. It is estimated that the entire cost of building, equipping, and securing the right of way of the new railroad will be in the aggregate $50,000,000, for which the funds, it is stated, have been provided in the form of stock and bonds. Contracts are now being entered into for the completion of the work on or before June 1, 1885. The corporate name of the company is the New York & Boston Inland Railroad Company. The charter for the State of New York was taken out and received from the Secretary of State about two months ago. In the State of Connecticut it is said that the stock has been subscribed for according to the legal requirements of law, and papers will be filed with the Secretary of State there in about two weeks. In Massachusetts the required amount of stock has been subscribed for, the corporation has been organized, officers have been elected, and plans and specifications will be filed with the Secretary of State during the coming week. The charter from this State was obtained last winter, under the title of the New York Construction Company, and at that time an outline of the scheme as far as possible was given. Under it there has been organized a corporation with a paid-up capital of $12,000,000, with a guarantee capital of $12,000,000. This corporation was organized about eight months ago, with authority to subscribe for and take securities in stock and bonds, make surveys, estimates, plans, build, furnish, and equip the whole or any part of the proposed railroad in the States of Massachusetts, Connecticut and New York.

It is proposed to run five daily express trains on this road, for through business each way, making no stops whatever between New York City and Boston, on a schedule time of four hours, and to run as many local trains as business may require in order to give local travel good accommodations, and also as many freight trains as the business shall demand, making the time of express freight trains between New York city and Boston eight hours. It is not known at present what other railroad combination is connected with the scheme, or whether the money is furnished by English capitalists, but it is surmised that Vanderbilt may be interested.

CONTRACTING, MISCELLANEOUS, ETC.

St. Paul Episcopal church congregation at Milwaukee are about to erect a new edifice at a cost of $100,000.

Mr. Meyer, whose plans for the new Texas State capitol at Austin were accepted, has furnished plans for new lunatic asylum buildings, and bids for construction are advertised, the construction to cost $95,000.

The experimental boring by the Illinois Central Railroad Company in the Ohio River at Cairo, with a view to testing the practicability of bridging the stream, has been discontinued. The shaft was sunk to a depth of 203 feet, but without striking a rock foundation.

C. E. Briant, of Wabash, Ind., has taken a contract to furnish new ties for the Wabash, St. Louis & Pacific railroad for a distance of one hundred and fifty miles. This distance includes the track between Fort Wayne and Lafayette, and Peru and Butler.

Messrs. Henry & Dilly, who have the contract for building forty miles on the Sunset extension between Devil's River and Pecos River, Texas, passed through Palestine on the 14th with a large contingent of men, whom they had brought from Joliet, Ill., to work on contract.